Volume 25 May, 1939 *Number 5*

Lubrication

A Technical Publication Devoted to the Selection and Use of Lubricants

THIS ISSUE

Lubrication of Railway Maintenance of Way Equipment

PUBLISHED BY
THE TEXAS COMPANY
TEXACO PETROLEUM PRODUCTS

ALL SAY "CLEAN

IS MOST IMPORTANT"

INGERSOLL-RAND COMPRESSOR with tie tampers and spike drivers at work in rail laying operation. Texaco Algol Oil is approved for this type of compressor, helps keep it at high efficiency.

NORDBERG PRECISION TRACK GRINDER powered by 8 h.p., single cylinder gasoline engine finishing top of rail. Insulated Texaco Motor Oil of the proper S.A.E. viscosity keeps these units clean, rings and valves free and active.

ANY SURVEY AMONG OPERATORS to determine what they most want from maintenance of way equipment discloses the fact that all want their compressors and other machines to stay clean.

Some speak of it as efficient valve action, still others mention maintained compression, rings free. Whatever they call it, it adds up to CLEAN valves, CLEAN air passages, CLEAN rings.

Any compressor or gasoline engine will stay clean when lubricated with oils specifically refined to meet the operating condition. Insulated Texaco Motor Oils and Alcaid, Algol, and Ursa Oils resist formation of gummy deposits. What little carbon forms is soft, fluffy, harmless.

Trained lubrication engineers will help you select the right one for your purpose.

Prompt deliveries assured wherever you may be. To order, call the nearest of our Railroad Offices, listed on the back page, or write direct to:

The Texas Company, 135 East 42nd Street, N. Y. C.

NEW! Texaco's 36-page Rock Drill Booklet. How they are built, how to lubricate them, to keep them on the job. It's yours for the asking.

TEXACO PERFECTED LUBRICATION

FOR RAILWAY MAINTENANCE EQUIPMENT

LUBRICATION

A Technical Publication Devoted to the Selection and Use of Lubricants

Published by

The Texas Company, 135 East 42nd Street, New York City

Copyright 1939 by The Texas Company

Vol. XXV May, 1939 No. 5

Change of Address: In reporting change of address kindly give both old and new addresses.

"While the contents of LUBRICATION are copyrighted, other publications will be granted permission to reprint on request, provided article is quoted exactly and credit given to THE TEXAS COMPANY."

Lubrication of Railway Maintenance of Way Equipment

THE question of how much maintenance during periods of reduced income is oftentimes most disturbing to management in many industries. Manufacturers can frequently let things slide, "rob" idle machinery to effect replacements on their production line, or purchase from "hand to mouth." The past several years have witnessed this very procedure, coupled with actual neglect in some cases.

In transportation, however, a different story prevails. The railroads have a vital responsibility to their shippers and passengers—they must operate with the utmost safety. Furthermore, they cannot plead for an extension of time. Their moral contracts with their traffic are their timetables.

So the railroads must be continually maintaining their roadbed at a high standard. They cannot run around a washout, take rails from a less used line to repair storm or flood damage or use second-grade ties. In addition, they must get their section crews to the job in a hurry, for much of the work in hand must be done "between trains."

Railway track maintenance is contingent, therefore, upon automotive power or the track motor car as the primary means of transporting men and materials to the job. Once there, power is necessary, hence the use of gasoline and electric power to operate certain types of track tools, and to run the air compressors which, in turn, furnish the power for the air-driven tools.

GASOLINE POWERED MACHINES

The Track Motor Car

The most prominent of these units is the track motor car. Following closely in popularity, however, are the gasoline engine driven air compressors, tie tampers, portable electric generators and various track machines.

All have been developed to further the objectives of extending the use of off-track equipment, eliminating work trains and enabling a section or bridge crew to proceed without delay to any point and work individually and independently of each other or of any other operations.

So the modern track motor car is a gasoline engine propelled vehicle, equipped with flanged wheels on an axle of suitable gage, which is mechanically connected to the engine. This mechanism will often work under unfavorable conditions, being exposed to the elements and overloaded, so protective lubrication of the various operating parts must be assured. This is obviously contingent upon three factors:

(1) Selection of lubricants which possess characteristics in line with the operating conditions,

(2) Their storage in a manner to assure of maximum protection, and

(3) Application or circulation by effective methods which will assure of complete and continuous coverage of the contact surfaces.

The engine is the primary mechanism on such a car. Both four-cycle and two-cycle

types are employed. There is also an option with regard to cylinder arrangement, one, two, three or four cylinders being employed according to the duty required. The two-cycle, air-cooled, single cylinder engine is widely used in light car service and in the gasoline operated self-contained type of tie tamper. For heavy work, in most cases, either the two or four cylinder air or water-cooled engine of either the two or four-cycle type is used.

The two-cycle engine has fewer parts than the four-cycle; furthermore, it can be readily reversed as it can run in either direction. The four-cycle engine requires a reversing mechanism; to offset all this, the latter is the more economical with regard to fuel.

It is interesting to note that the cycle frequency will have an effect upon the operating temperature of the engine. The two-cycle engine will usually run hotter than the four-cycle due to the explosion occurring on every second stroke. This feature, on the other hand, develops more power for the same weight of engine. In contrast, however, the two-cycle engine may present a problem of cooling, and often a heavier oil must be used.

Two-Cycle Engine Lubrication

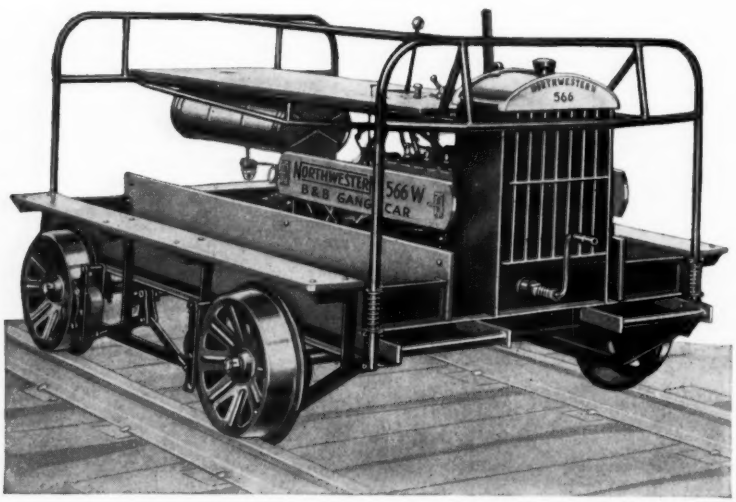
Two-cycle engines are lubricated by mixing the lubricating oil with the fuel. The amount of oil to be used will depend on whether the engine is air or water-cooled and the nature of the work it is called upon to perform. Ordinarily, from one to two quarts of lubricating oil to five gallons of gasoline will give satisfactory lubrication. There will be occasions, however, when this proportion will have to be decreased or increased, depending upon the nature of work the engine is called upon to perform and the atmospheric temperature. In the same type of work the air-cooled engine may sometimes require a richer mixture of oil and fuel than a water-cooled engine.

The oil and fuel should at all times be accurately measured and thoroughly mixed before being put into the fuel tank. Mixing may be accelerated in cold weather by slightly heating the lubricating oil before adding it to the fuel. If this is not done and the oil is poured into the tank without mixing, it will settle to the bottom of the tank with a tendency to clog the fuel line and give considerable carburetor trouble, and eventually no lubrication at all. Where the oil and fuel are mixed a high grade lubricant should always be used, and it should be suited in every way to the engine.

It will necessarily require more of a poor grade oil to properly lubricate such an engine than of an oil especially designed for this purpose; furthermore, should the mixture become too heavy to vaporize properly in the carburetor, there will be slow burning in the combustion chamber with the formation of considerable carbon. As this latter develops, the ports will become restricted, the deflector filled up, rings will stick and there will be a general reduction in efficiency of the entire engine. There will always be some carbon formed, even with the best oil; but the better the oil used, the longer the engine will continue to run well and keep clean.

In other words it should be of such a character that it will leave a minimum of carbon deposit and that this shall be of a soft fluffy nature. If this is of a hard crystalline nature, its presence will be manifested by overheating of the engine, with a decided loss of power and a generally poor running machine.

In addition to the formation of carbon, when using poor lubricating oil, we do not get as effective a piston seal between the piston rings and cylinder walls with an inferior oil as with one designed especially for the type of engines in track motor cars. Unless this seal is maintained, the engine will not develop the proper compression for the most powerful explosion.



Courtesy of Northwestern Motor Company

Fig. 1—A Northwestern 566 W B & B gang car equipped with a Waukesha FC-4 cylinder engine.

Viscosity Range

In view of the desirability of using an all-

year type of oil in such service, considerable field research has been carried out by the petroleum industry with the cooperation of the railway engineering personnel in many parts of the United States. It has resulted in the production of some highly satisfactory lubricating oils within the S.A.E.-20 to 60 range, acceptable to the engine builders and suited to a wide range of operating conditions.

Obviously, these oils are of a high degree of refinement, resistant to breakdown under high temperatures and possessed of the necessary relative fluidity to enable their usage under quite extreme weather conditions.

The Four-Cycle Engine

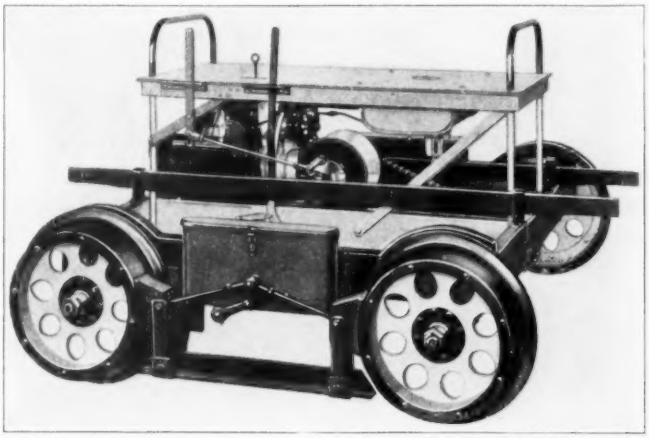
This engine may be either air or water-cooled and provided with a very efficient system for force-feed or splash lubrication. When this type of engine is running properly, the lubricating oil will be subjected to considerably lower temperatures than in the two-cycle engine. This is in part attributable to the cooling action of the oil as it circulates through the engine mechanisms. On the other hand, this oil, as in the automotive engine, is often subjected to very severe operating conditions. It may be diluted by gasoline working past the piston rings, and it may be contaminated by dust and dirt which may work into the crankcase. Dilution will reduce the viscosity or body of the oil; accumulations of dust and dirt may interfere with free operation of the oil pump or circulation throughout the engine.

In addition, where poorly refined oils are used in any crankcase oiling system, they may accelerate formation of sludge, due to agitation of the oil at high temperatures after it has been diluted with unburned fuel. Water, as a product of combustion, assists in this formation of sludge, which tends to plug up the oil screen and to clog small oil holes and passages leading to important bearings.

It is, therefore, necessary and essential to observe regular periods for draining and cleaning the crankcase of the four-cycle engine. At the same time, this procedure will enable the operators to use seasonal grades of oil according to climatic conditions. In the selection of such oils, it is well to observe the S.A.E. viscosity range which is recommended by the engine manufacturer. Here, as in the case of the two-cycle engine, one can likewise expect that the S.A.E. 20 to 60 range will apply to the usual operating conditions. Use only the best grades of gasoline and lubricating oil, otherwise serious sludge difficulties may be experienced.

Method of Drive

A variety of drives are used in track motor car design. To some extent the application will depend upon the type of engine. The modern method is to select the drive to suit the power available, ease of starting and the loads to be carried.



Courtesy of The Buda Company

Fig. 2—The Buda track motor car.

Many four-cycle engines are designed to drive the car through a friction drive; others employ a conventional automotive transmission gear set. There is a decided contrast between these assemblies and the belt or chain drive which has been used on many two-cycle jobs. In the former, the speed of the car is controlled by shifting the position of the friction disk-drive, or by the speed of the engine and the gear ratio. The speed of the engine alone, however, is used to control the car speed with some types of two-cycle engine cars; in others, speeds can be varied by slipping the clutch.

A free-running drive is preferred by many as it facilitates starting with heavy loads. The use of a clutch also permits stopping the car without stopping the engine.

While it may be of advantage to the operator to have the flexibility of transmission gears, he is confronted with another part to be lubricated. He must be careful in attending to this latter, for, unless his gearing is protected by a suitably refined gear lubricant, car efficiency and ease of handling will be reduced. It is especially important to use seasonal grades of gear lubricants, especially where weather conditions may be extreme. By following automotive practice and changing lubricants as advised, but little trouble should result.

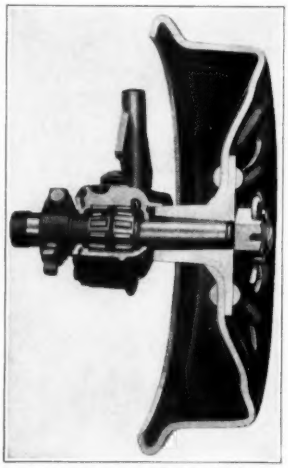
Axle Design

The differential axle is a unique development in track motor car design; it is claimed by some to eliminate the problem of loose wheels and loose wheel bushings. It is also claimed to be advantageous on heavy cars covering high mileage or service involving numerous curves. The wheels on cars so equipped are interchangeable. The necessary mechanism, however, presents a point which must be properly lubricated. This is effected by grease cup or pressure gun, using a comparatively pliable grease, but one which can be retained within the housing; or, anti-friction bearings can be used which, after once being lubricated, will run indefinitely on this charge of lubricant.

Axle Bearings

Track motor car axle bearings today are largely of the anti-friction roller type. These bearings are carefully housed to retain their charge of lubricant, so they are usually packed with a special bearing grease when assembled. In some cars, however, oil is used as the makeup lubricant. To facilitate application, a suitable orifice is provided in the bearing housing in which a wick is inserted. The latter prevents entry of dust or dirt and also filters the oil before it reaches the bearing.

Another type of roller bearing axle housing carries a pressure gun fitting. Here the same grease as is used for packing the bearing should be used when relubrication is necessary.



Courtesy of Fairbanks, Morse & Company

Fig. 3—Cut-away of a Fairbanks, Morse axle bearing housing showing the double Timken tapered roller bearing.

The waste-packed plain bearing, however, is designed for relubrication in much the same manner as the A.R.A. journal box. When these bearings wear, they will leak oil and also permit entry of track dust to accelerate wear. At least one road has found it advantageous under such conditions to replace the waste with a heavy fibrous grease.

Chain Drives

These units are usually exposed, so protection of chain links and sprocket teeth requires the use of a type of lubricant which will seal the pins and rollers against track dust or dirt. It is somewhat the same as lubricating a motor-truck chain or a shackle pin bearing with grease, the lubricant forming a protective collar at the exterior of the clearance spaces.

A 140-250 S.A.E. automotive type straight mineral gear lubricant will function well in this service, although a lime-soap grease carrying a heavy mineral oil can also be used effectively. Chain builders advocate dipping and soaking these mechanisms in used engine or flushing oil whenever the overhaul program permits to wash out the pin, roller and bushing clearances.

Other Parts

The lubrication of other parts of the car should not be difficult. Where there are provisions for grease lubrication on brake connections, loose wheels and axle boxes a good grade of cup grease of about No. 3 consistency which will not melt out too easily should be used. The frequency of relubrication will depend on the class of service the car performs.

For general lubrication where oil is employed using cup or hand oiling, the lubricant that is used for the engine will answer all purposes.

Lubrication of the transmission mechanism will depend entirely on the arrangement employed and the type of car. Gearing should generally be serviced with a good grade of straight petroleum gear lubricant having a viscosity of about 200 seconds Saybolt at 210 degrees Fahr. This lubricant should be capable of maintaining a sufficient film between the gear teeth, but never so heavy as to cause an excessive consumption of power. Use a S.A.E.-140 transmission lubricant for low temperatures, and a S.A.E.-250 lubricant in warm weather.

Viscosity or body of the oil is a measure of the relative fluidity at the denoted temperature. Viscosity will vary inversely with temperature, hence the colder an oil, the heavier will it become. Conversely, it will become more fluid on heating. The Society of Automotive Engineers have adopted a method of numbering automotive engine and gear oils for the purpose of standardization. These ratings, however, have no bearing upon the lubricating ability of any oil.

GAS-ELECTRIC POWERED TAMPERS

The electrically operated tie tamper is another progressive development which has been devised for the maintenance of way department.

This mechanism is run by electric power developed by a gasoline engine-driven generator. This class of equipment is of two types:

(1) The percussive or "hammer blow" operated by a solenoid magnet coil

wound around a hollow stainless steel barrel in which a free floating piston moves up and down, striking directly on the tool, and

(2) The vibratory machine operated by an electric vibratory motor with a heavy unbalanced weight attached to the shaft. This unit develops 3600 impulses per minute.

Lubrication is of considerable importance in maintaining the efficiency of both the power generating element and the tampers. The latter in particular should at all times maintain approximately the speed for which designed; otherwise, overheating may occur which may reduce the durability of the bearing lubricating film. This film can be maintained by means of oil of the type used in the crankcase of the engine, i.e., within the S.A.E. 30 range.

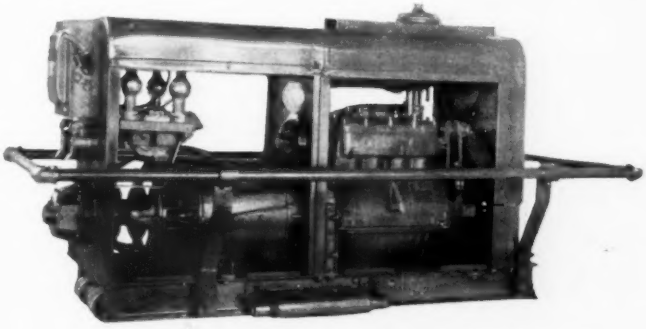
The power generating element in turn will normally involve a four-cycle automotive type gasoline engine. Lubrication of this latter has already been discussed. The same oil can be used on the generator bearings where these are intended to be oil-lubricated. The more modern type of generator, however, is designed for grease lubrication by means of a medium consistency anti-friction bearing grease. This materially reduces the frequency of relubrication for it is necessary to repack the bearings only two or three times a year. The oil-lubricated bearing, however, should be serviced once every day.

THE USE OF AIR POWER

Air power in railway maintenance work was materially extended with the development of the portable compressor. Immediately it enabled the mechanization of a number of operations which theretofore had to be performed by hand.

The pneumatic tie tamper proved one of the most adaptable, as it speeded up operation, relieved the drudgery of the laborers, produced a more uniformly tamped roadbed, did not crush the ballast or injure the ties, and reduced the cost of track surfacing.

Other pneumatic tools which were later perfected included the rail drill, bonding drill, wood borer, rail grinder, air saw, nut runner, spike driver and spike puller.



Courtesy of Syntron Company

Fig. 1—The Syntron portable electric power unit, equipped with a four cylinder gasoline engine directly connected to a separately excited A.C. generator. This is used in operating the percussive type of tamper.

Compressor Details

Compressor designers have gone largely to the one or two-stage air or water-cooled reciprocating compressor driven by a four-cycle gasoline engine. Some are built with their cylinders in line; others have their cylinders arranged as a "V" or "W". In the latter type, the vertical cylinder is the high pressure element, the wing cylinders being low pressure.

By employing the two-stage principle with adequate provision for intercooling, the unit will not only deliver more air at the required operating pressure but also the temperatures of compression will be lower, thereby reducing the possibility of carbon formation and accumulation of deposits, especially if oils unsuited to the operating conditions are used.

Selection of Compressor Oil

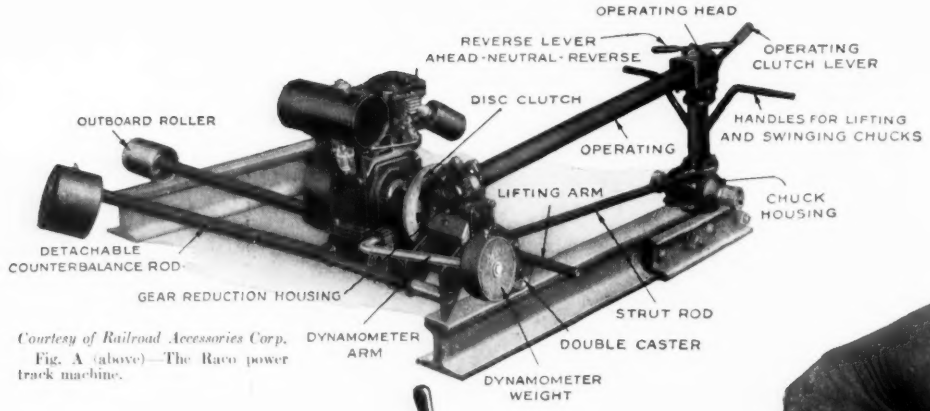
Air compressor cylinder lubrication requires an oil which possesses certain very definite properties. It must not only lubricate effectively and resist water-wash when moist air is being handled, but at the same time it must resist decomposition when exposed to heated air, otherwise it might become a hazard due to possibility of explosion. Those properties which will indicate the ability of the oil to meet the above requirements are covered by the relative change in viscosity and the tendency to form carbon deposits. In service, the suitability of the oil will be indicated by reduction in noise and prevention of "groaning."

The Effect of Change in Viscosity

To understand the importance of viscosity, one must realize that the body of the oil will be subject to change in its relative fluidity with change in temperature. Due to the extent to which cylinder wall temperatures will vary, the viscosity of the oil used must, therefore, be given careful consideration for the degree of piston seal attainable can be judged by the indicated viscosity of the oil at operating temperatures. This, in turn, will affect the efficiency of compression.

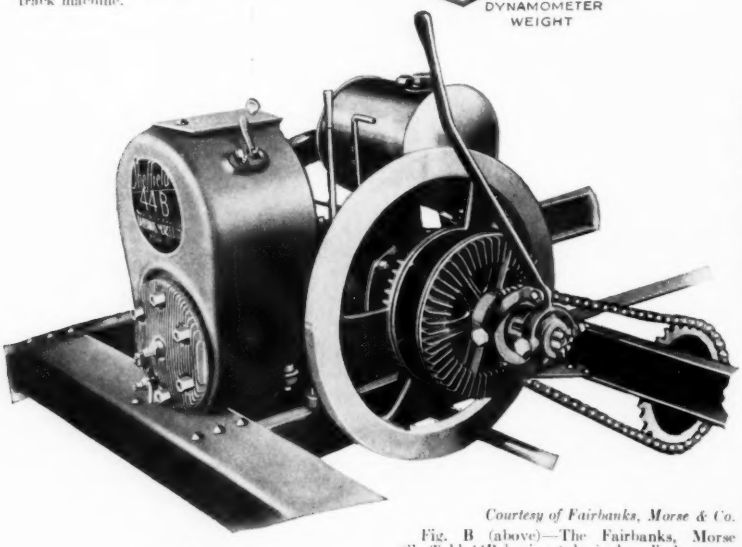
Should the oil be too low in viscosity at the

Railway Equipm



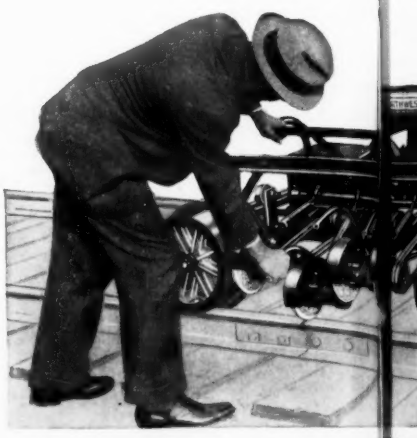
Courtesy of Railroad Accessories Corp.

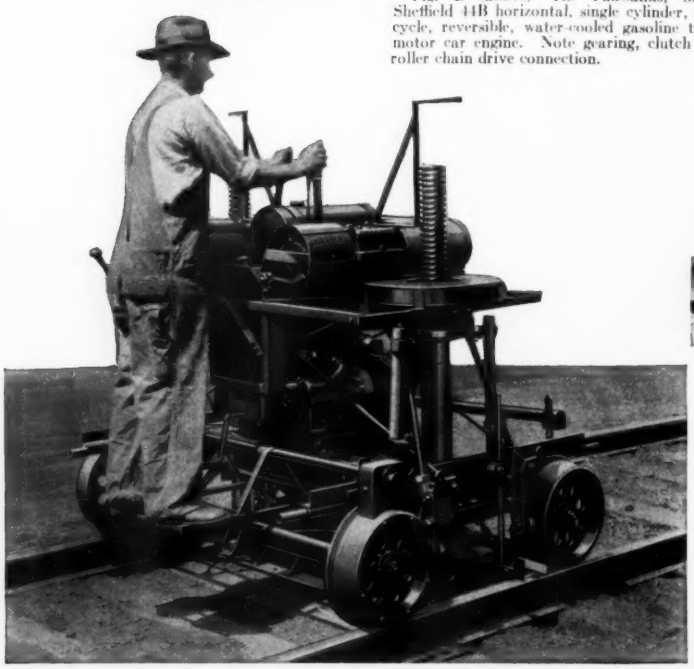
Fig. A (above)—The Raco power track machine.



Courtesy of Fairbanks, Morse & Co.

Fig. B (above)—The Fairbanks, Morse Sheffield 44B horizontal, single cylinder, two-cycle, reversible, water-cooled gasoline track motor car engine. Note gearing, clutch and roller chain drive connection.





Courtesy of The Buda Company

Fig. C (above)—Tie tamping by means of Buda portable gasoline engine driven equipment.

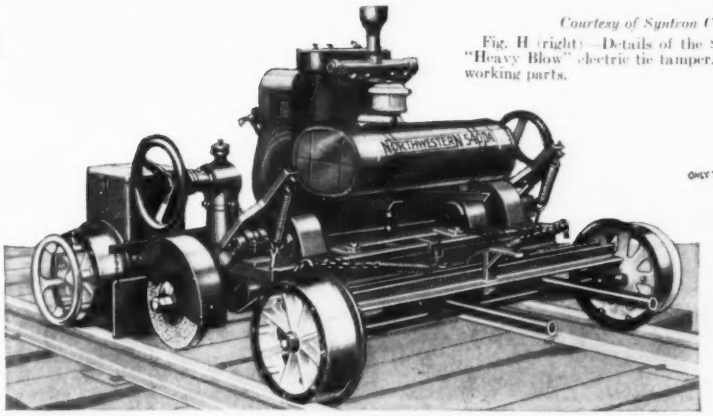
Courtesy of Nordberg Manufacturing Company

Fig. D (left)—The Nordberg power jack for raising track prior to ballasting. Power is supplied by a four-cylinder gasoline engine.

Courtesy of Nordberg Manufacturing Company

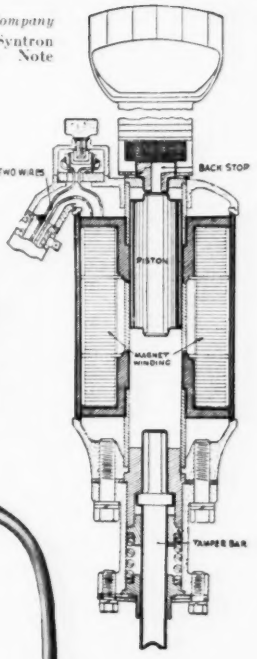
Fig. E (right)—The Nordberg adzing machine. Here a four cylinder gasoline engine supplies the power through belt connection.

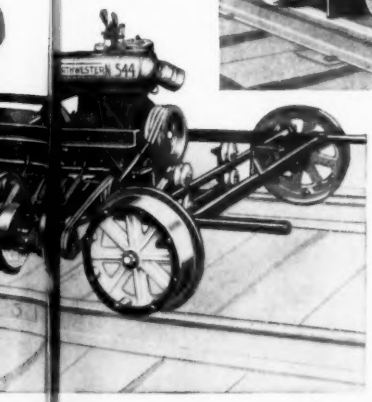
lwa Work
quipment



Courtesy of Syntron Company

Fig. H (right)—Details of the Syntron "Heavy Blow" electric tie tamper. Note working parts.



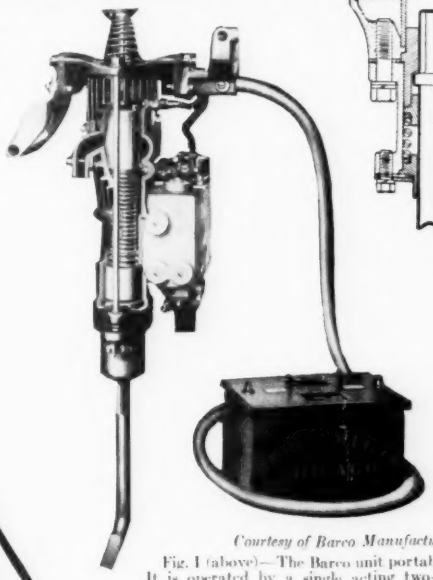


Courtesy of Northwestern Motor Company

Fig. G (above)—The Northwestern rail and frog grinder.

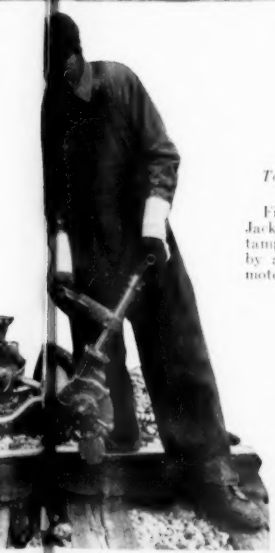
Courtesy of Northwestern Motor Company

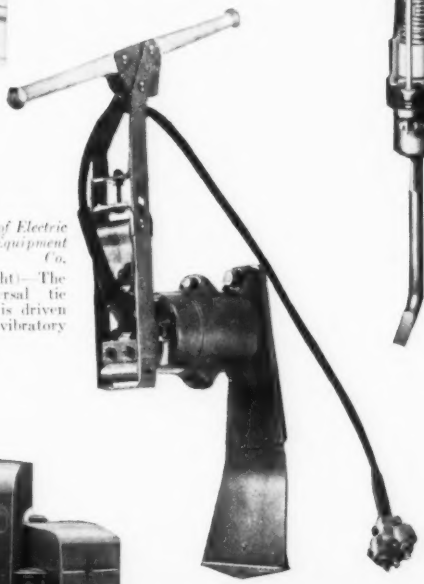
Fig. F (left)—The Northwestern 544 rail joint slotter and beveler.



Courtesy of Barco Manufacturing Company

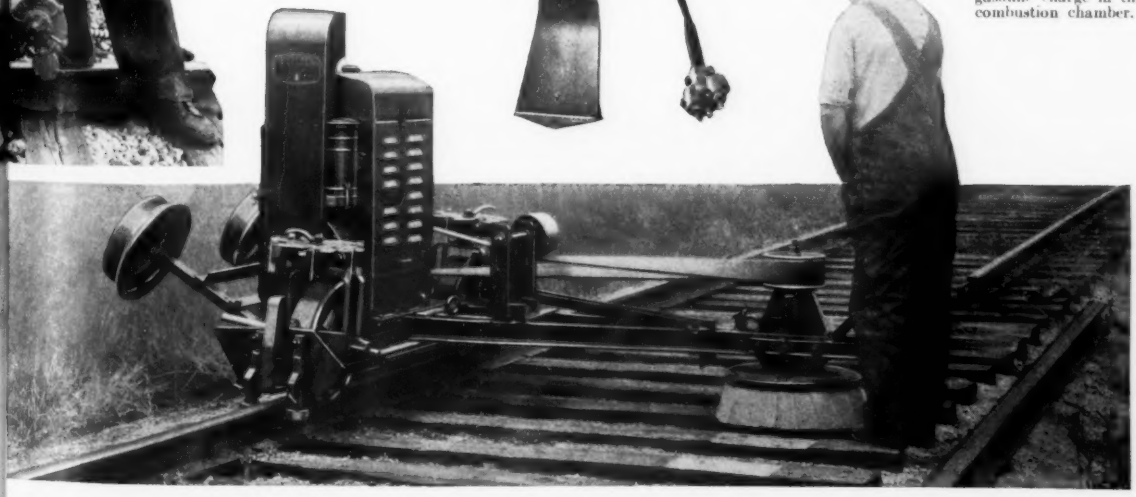
Fig. I (above)—The Barco unit portable Tyetamper. It is operated by a single acting two-cycle gasoline engine with spring-returned piston; the downward strokes, at the approximate rate of 1300 blows per minute, are caused by explosion of the gasoline charge in the combustion chamber.



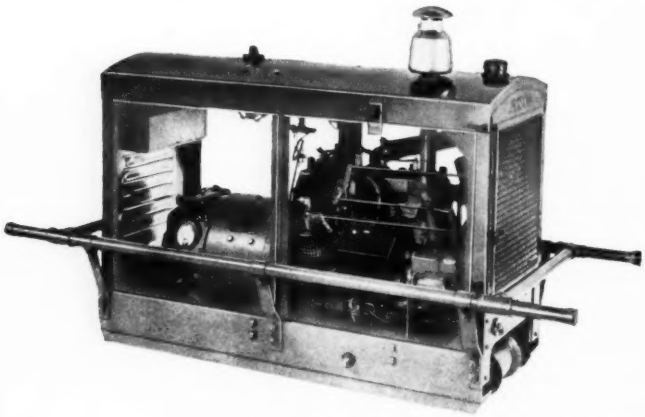


Courtesy of Electric Tamper and Equipment Co.

Fig. J (right)—The Jackson Universal tie tamper. This is driven by an electric vibratory motor.



operating temperatures in the cylinders, it might not have sufficient film strength to maintain the necessary seal between the piston rings and cylinder walls. Too heavy an oil would, in turn, tend to develop gummy matter, which would result in the piston rings becoming stuck.



Courtesy of Electric Tamper and Equipment Company

Fig. 5—The Jackson portable electric power plant as designed for operating the vibratory tie tamper. The gasoline (four cycle) engine-driven generator develops alternating current, which in turn runs the vibratory motor of the tamper.

So the oil must be right for the prevailing atmospheric conditions. In hot, humid localities a 500 viscosity range at 100 degrees Fahr., may often be necessary to give the desired operating viscosity, with reduction to perhaps 200 seconds when the unit is to function in the winter. In other words, an air compressor oil should have a viscosity high enough to sustain the weight of the moving parts and form a proper seal between the piston rings and cylinder walls, but it should never be so heavy as to atomize with difficulty or develop excessive internal friction within itself. Moreover, if too heavy an oil is used, the resultant film on the cylinder walls will more easily collect any dust that may be present in the air and bake on the hot surfaces to form carbon deposits. This is especially likely to happen when there is no air cleaner or an excess of oil has been used.

Another point, as some roads rely upon the oil carried over by the compressed air from the compressor to lubricate their tie tampers and other air tools, the vaporizing tendency of the compressor oil becomes of added importance. Here, the oil must be so refined as to remain in mist form in the air until the latter has passed through the tools, when it automatically gives up this oil content to insure their lubrication.

Flash and Fire Points

Flash and fire points are often stressed too forcibly in regard to their relation to effective compressor cylinder lubrication. In other words, high flash and fire points may be decidedly over-emphasized as to their relative importance in air compressor lubricants. Obviously, the proponents of high flash and fire are concerned about explosions. On the other hand, the conditions under which explosions will tend to occur have indicated that the possibility of formation of deposits within the compressor or air lines requires far more consideration.

Wherever they are present and rendered incandescent, an explosion may occur irrespective of the flash or fire points of the lubricating oil. Otherwise, the oil would have to be exposed to a temperature much higher than its laboratory flash point before combustion could take place. The former will normally range in the neighborhood of 325 to 430 degrees Fahr., whereas the temperature of auto combustion (burning by heat alone, without the application of fire) would be several hundred degrees higher, so it is unwarranted to worry as to the possibility of certain compressor oils being the more explosive, simply because their flash point is below the temperature of the discharged air.

It is also important to remember that air temperatures are controlled by effective intercooling (in two-stage compressors) and that cylinder walls of the portable railway compressor are likewise adequately cooled; hence the temperature of the oil layer next to the walls will normally be but little above that of the walls themselves. The oil layer exposed to the heated air, however, becomes much hotter than the rest of the oil body and a portion of it may be atomized or vaporized. Frequently this is desirable as already explained. As oils are composite mixtures, different portions will be distilled or vaporized at different temperatures. Certain of the lighter products may pass off even at temperatures below the flash point, leaving the heavy ends dissolved in the oil next to the walls. The final result, especially where an excess of high carbon content oil is used, may be oxidation and the building up of a gummy mass which has a low vapor pressure and high distillation point.

Oil Breakdown Causes Carbon

As a result, the indicated carbon residue content should be studied as well as the degree of refinement of the oil. It is impossible to get away from oil breakdown for mineral lubricating oils, regardless of their base or nature, will decompose to volatile products and carbon

when subjected to hot air under pressure. The extent of this decomposition will depend on the length of time the oil is exposed to such heat. It will also follow that with oils of the same degree of refinement the one which remains in the compressor cylinder or on the discharge valves the longest will form the greatest amount of carbon.

Dirt will also be included, especially where an air cleaner is not used, the whole mass being held together by gummy matter from decomposed oil, especially where the latter has been unsuited to the service involved. Obviously, an oil having a wide range of distillation, high end point or too great a viscosity is objectionable for, instead of vaporizing cleanly, it breaks down, becoming sticky and collecting dirt brought in by the air. The slower this breaking-down process or the greater the amount of oil, the more carbon can be expected.

Carbon in its true form may develop in air compressor cylinders in a hard mass, or it may be produced in the shape of dust and pass out with the air. In the latter case, it will often collect in pockets, elbows or on sharp edges to become mixed with dirt taken in by the air, as well as with oil which has been vaporized in the cylinder and condensed later after cooling. Accumulations of this nature in the receiver are objectionable, for, if extensive, the oil content may gasify and become explosive.

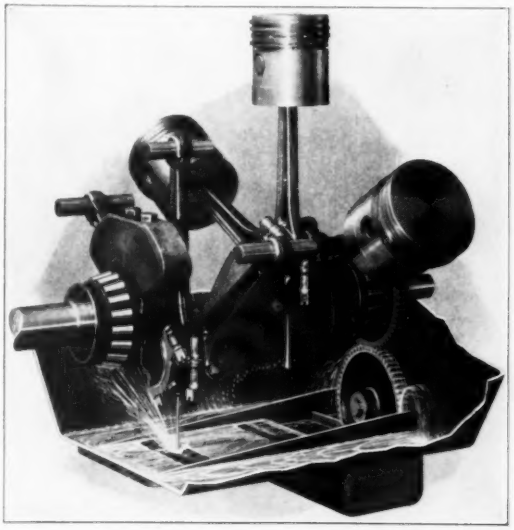
Since carbon is a poor conductor of heat when deposited in cylinders, it may become heated considerably above the temperatures of the cylinder walls. This may ultimately be hazardous if allowed to continue. Furthermore, there will be possibility of accumulations developing on the valves and valve seats and in the ends of the cylinders. This may cause valves to leak, frequently resulting in cutting and loss of efficiency.

Pale filtered distilled oils, where properly refined, show the least tendency toward direct carbonization and the development of carbonaceous matter so they are generally accepted as best suited to air compressor service. Furthermore, any direct carbon as may be formed through excessive use of such oils is normally of a light fluffy nature.

If an effective air cleaner is also used, added protection is afforded against dust or dirt being carried into the pneumatic system with the air. The cleaner functions like an air filter in the modern automobile; cleaning of its filtering media is very important, especially in dusty areas. Use kerosine for this purpose, unless it is self-cleaning.

PNEUMATIC TRACK TOOL LUBRICATION

The railway type of pneumatic tool dates back some twenty-five years. The use of the air-driven tie tamper pioneered this development; with its success air power was rapidly extended to certain of the other mechanisms already outlined.



Courtesy of Ingersoll-Rand Company

Fig. 6—Details of the Ingersoll-Rand T-40 portable air compressor crankshaft and piston assembly showing method of oil distribution.

Since then, tool designers have progressed markedly in their studies of ways and means to insure protection of the working parts through dependable lubrication. They have given particular attention to construction and protection of all mechanisms by oil tight seals which not only prevent leakage of lubricant, but also entry of abrasive foreign matter. This latter may be especially harmful to parts if it works into the mechanisms for it will promote wear, cause increased clearances, and bring about noisy operation with marked decrease in efficiency. So thorough understanding of design, lubricant application and the physical limitations of air tool lubricants will be especially helpful to the operator in railway track maintenance work.

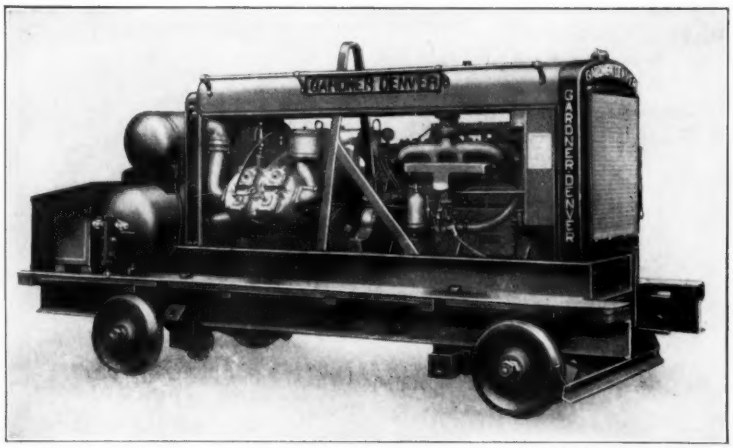
Both rotating and reciprocating elements must be considered when selecting these lubricants. Each presents a specific problem with regard to potential wear. To meet this requirement three distinct types of lubricants are available, viz.:

(1) Compounded cylinder oils as required for tools exposed to considerable moisture.

(2) Light viscosity straight mineral oils of sufficiently low pour point to serve the

valves, cylinders and bearings of high-speed tools.

(3) Light-to-medium consistency greases adaptable to heavier, slow moving parts, or parts specifically designed for grease lubrication.



Courtesy of Gardner-Denver Company

Fig. 7—The Gardner-Denver gasoline engine-driven railroad type of water-cooled portable air compressor. To protect the air and maintain suitable discharge temperatures, an oil bath air filter and an air-cooled intercooler are used.

These products must be capable of functioning with the least amount of internal friction, and they must not develop acidity. So they are manufactured with extreme care. The same consideration should be given to their selection and usage in railway maintenance work. The track tool builder designs, in turn, for lubricant protection in service by providing suitable seals, lubricators and other means for preventing contamination by dust, dirt or water. He fully realizes the rough usage they will get. Their rugged nature, however, may deceive some as to the intricate mechanisms contained within. It is these mechanisms which we must protect by lubrication in the realization that it is relatively difficult for any lubricant to function at its best under the service conditions which accompany track maintenance.

The Washing Action of Water

Water, which may enter a tool mechanism either with the air or through leakage, will tend to wash off the lubricating film from any interior surface exposed thereto. For this reason, compounded mineral oils of relatively high viscosity containing more or less animal oil in compound are recommended wherever the equipment may have to operate in the presence of water. Such lubricants function on the same principle as do steam cylinder oils in that they emulsify with water by virtue of their fatty oil content, creating an adhesive emulsion which adequately resists the washing effects of water and sticks tenaciously to all wearing elements. But such lubricants are recommended only for air tools wherein water is entrained in the air due to atmospheric or operating conditions.

Where track tools are designed to function dry, they should be as free from moisture as possible. On such equipment, straight mineral lubricants are used. If these latter have been properly refined and are of the requisite viscosity and pour test, they will withstand adequately any washing effect that may result from condensation of moisture from compressed air as normally used. They will not, however, protect the wearing surfaces against an excess of moisture as may occur if the tool is dropped in the mud or allowed to remain exposed to the elements for any length of time (with the throttle or valve open) while not in use. Rusting and corrosion will result with subsequent difficulty in operation, an inability to perform the rated amount of work and the necessity for repair or replacement of parts.

The Abrasive Effects of Dust and Dirt

Careless handling of track tools may enable dust and dirt to gain entry; this, along with the dirt which may be carried through the tool by the air itself, will be detrimental as a potential cause of wear.

It is normally easier to protect against the entry of abrasive foreign matter via the tool itself than via the air line. All that is usually necessary is care in handling when not in actual operation. Rarely will any appreciable amount of dirt penetrate while air is passing through. If it is, therefore, stored or rested in a position or locality free from dirt when not in use, it should function satisfactorily for an indefinite period. Closing the throttle or valve or plugging the tool at the hose connection is also a good idea.

It is not always possible to obtain clean air, however, for this will depend upon the location of the compressor, its air intakes, whether or not air filters are installed, and the cleanliness of the inter-coolers and air lines. Furthermore, there will also be the possibility of particles of rust being carried along by the air,

especially where lubrication has not been adequate in the protection of those parts of the system exposed to moisture. This, along with shreds of rubber from the air hose and gaskets which may be carried into the air passages and cylinders, will materially interfere with the free operation of the mechanisms.

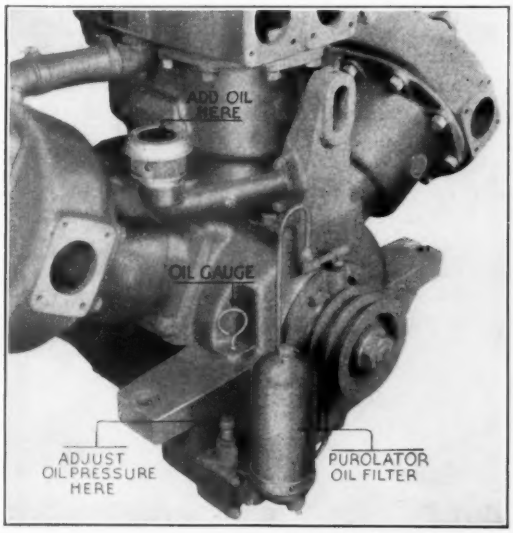
A dust-proof strainer of suitable fineness in each inlet pipe will often remove the greater part of any solid foreign matter and protect the working mechanisms. This strainer must be cleaned at frequent and regular intervals. Care in handling and delivery of lubricants to prevent entry of foreign matter will also be advisable.

Where tie tampers, rail drills, grinders, air saws, etc., must be periodically oiled by hand, there may be considerable possibility of accidental entry of dust or dirt. The operator's hands will be dirty and the atmosphere will often carry a good deal of dust. Under such conditions, the lubricants for current usage should always be stored and handled with the utmost care. They should never be kept in open cans adjacent to the tools just for the sake of handiness or to eliminate loss of time when lubricating. Under such conditions considerable dust and dirt will be bound to settle in these containers with the result that the tools may be ultimately lubricated with an abrasive compound which will accelerate wear and increase the repair costs. It is also a good rule never to apply lubricants to tools when trains are passing, or when tamping; cinders, dust and dirt readily find their way into the mechanisms at such times; the modern method of grease-lubricating tie tampers eliminates this possibility to a considerable extent. (See Fig. 9.)

Methods of Lubrication

While the type and extent of refinement of the lubricants employed have much to do with efficient operation of our modern track tools, the means whereby the former are applied or distributed has a marked effect upon their ability to function effectively. It is evident that even the best of oils or greases may fail to do their work if they are haphazardly used or applied in such a manner as to be unable to reach all the wearing elements of the tools. More failures or complaints arise from ineffectual lubrication through misusage of lubricants than from any average operating condition. In many cases this will be due to ignorance; in others, neglect, often because the operator does not appreciate the lubricating requirements of his equipment.

There are many excellent oils and greases on the market, in most cases refined more or less especially to serve pneumatic tools, with a minimum of fluid friction, a maximum of sealing power in the prevention of air blow-by past the pistons, excellent lubricating ability and a pour test commensurate with the operating requirements. It is obviously up to the operator to use these products intelligently in ac-



Courtesy of Gardner-Denver Company

Fig. 8—Details of the Gardner-Denver air compressor oiling system.

cordance with the recommendations of the builders of his tools and of the oil company from whom he purchases. Some roads have organized their work equipment divisions to include inspectors who periodically check up the performance of such equipment. Others attach oil viscosity tags specifying the S.A.E. viscosity number of oil to be used on each unit.

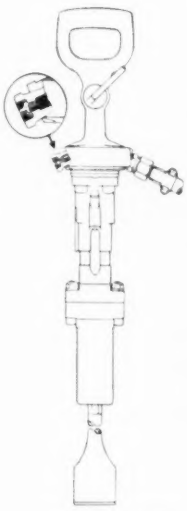
The Benefits of Cleanliness

Cleanliness is definitely allied to effective operation and dependable lubrication. Cleaning can best be accomplished by using a solvent such as kerosine or gasoline. Normally, these will cut any gummy residues and enable them to be washed out. Gasoline, however, should be used only in the open, never indoors. Where greases are used, there will often be a tendency for accumulation of gummy residual matter. Dust, dirt or water will aid in developing such formations, as well as adding an abrasive element. Such matter, therefore, should never be allowed to become so extensive as to interfere with free motion of the tool mechanisms. Smaller tool parts often can be freed of non-lubricating accumulations by submergence in a bath of kerosine or S.A.E.-10 motor oil for a few hours and blowing out thoroughly with air.

Large tools, however, may require dis-

assembling to a more or less extent when cleaning is necessary. If the tool has been laid up for any length of time, the parts should be soaked in solvent to soften or cut any gummy matter and permit of easy washing off of such other foreign residuum which may not be entirely soluble.

It is possible to prevent accumulations of foreign matter by storing track tools in a bath of flushing oil or light motor oil (S.A.E.-10 or 20) whenever they are not in use. This will prevent oxidation by eliminating contact with air; otherwise, were the latter at all moist, it would promote the formation of rust, corrosive matter and gummy residues from certain classes of lubricants. Prior to reusage, the tools should be thoroughly relubricated with fresh oil or grease which is suited to the operating conditions. It is also a good idea to blow out air lines after the tools have been idle (especially over night) to remove any water that may have condensed therein.



Courtesy of Ingersoll-Rand Company

Fig. 9—The Ingersoll-Rand grease lubricated pneumatic tie-tamper. Note pressure grease fitting below the handle.

Miscellaneous Operations

The mechanisms essential to the operation of other more mechanical types of track machines will require a medium to heavy machine oil or medium consistency grease according to the bearing design, the provisions for relubrication or the type of housing provided for retention of the lubricant. Sometimes, however, a unique design must be serviced, as involved in the elevating screw of the track-raising machine or the gathering mechanism on the ballast cleaning machine. Both are quite exposed and subject to heavy loads, so the greases used must be resistant to the weather and sufficiently heavy to carry the pressures. In addition, they must be adhesive for if they drop off prematurely in warm weather their protective value is reduced.

DON'TS

Don't use lubricants which are not approved for the machine to be lubricated.

Don't forget that all lubricants may become contaminated. Remember, therefore, to examine and renew lubricants at regular intervals in accordance with manufacturer's recommendations.

Don't store lubricants in uncovered containers.

Don't distribute lubricants in excessive quantity, or in unsuitable or uncovered containers.

Don't over-lubricate. This is often indicated by accumulations of oil or grease on the outside of the machine.

Don't store tools exposed to the weather. Use covers where provided.

Don't start up any track work machine before making careful inspection to see that all parts are properly lubricated.

Don't operate a four-cycle gasoline engine at high speed until it has been thoroughly warmed up; this insures proper circulation of oil through and to all parts.

Don't apply lubricants by hand when a machine is moving. Stop; then lubricate.

Don't use gasoline to clean air strainers, filters or any other mechanisms, unless the machine is disassembled and out in the open. Kerosine is safer at any time.

CAUTIONS

Always wipe off pressure grease gun fittings with a clean cloth before attaching the gun; this prevents non-lubricating foreign matter from being forced into the bearing clearances.

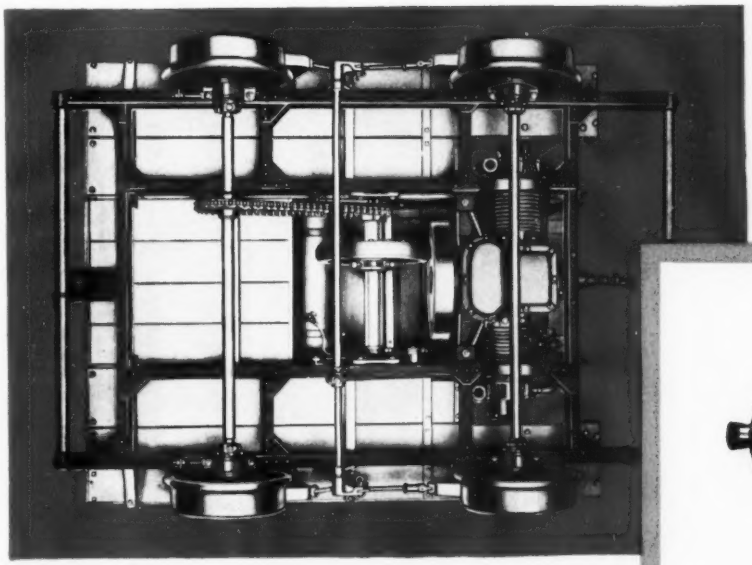
Remove pressure grease cups periodically for cleaning, to remove accumulated foreign matter which might prevent passage of grease to the bearings.

When necessary to dismantle a machine on the right of way, observe every care in reassembling to see that the parts are thoroughly cleaned and lubricated.

Blow out air lines regularly before hooking up air tools; also drain air receiver to remove any oil or water which may have settled therein.

Printed in U. S. A. by
EDGAR C. RUWE CO., INC.
72 Washington St., N. Y. C.

MAINTENANCE EQUIPMENT STEPS UP!



FAIRBANKS-MORSE track car wheel axle housing equipped with Timken Tapered Roller Bearings. Texaco Greases are approved for these bearings.

FAIRBANKS-MORSE Railroad Motor Car underbody showing details of frame construction, engine supports and bearing connections. Most of these bearings are of the anti-friction type. Texaco Greases properly applied will maintain them at peak under heaviest service.

BUILDERS of railroad maintenance-of-way equipment are constantly finding new applications for anti-friction bearings.

Following the advice of the manufacturers, maintenance engineers are giving close attention to the lubrication of these bearings.

More and more, they are turning to Texaco Marfak and Texaco Starfak . . . approved by leading makers of ball and roller bearings.

Laboratory tests, often carried to the point of breakdown of equipment, have proved that these lubricants will not separate or break down to leave harmful non-lubricating material in the bearings.

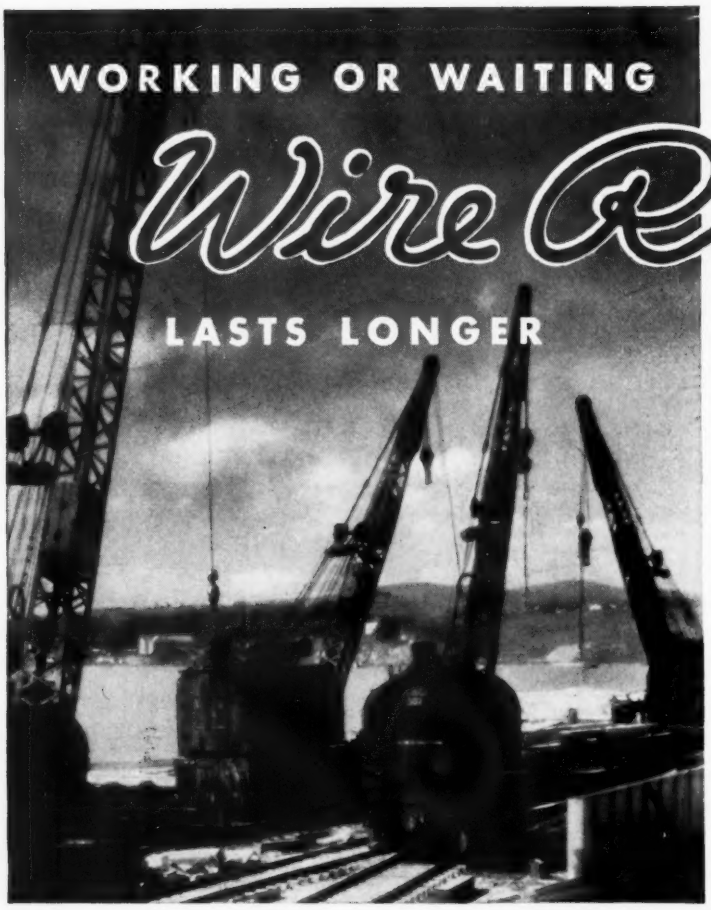
Increased bearing life is thus assured, maintenance and replacement costs reduced. Texaco Greases are available for every speed and load condition. A Texaco engineer experienced in the selection and application of lubricants for railway maintenance-of-way equipment will gladly tell you which to use. Phone the nearest of our railroad offices, listed on the last page, or write direct to:

The Texas Company, 135 East 42nd St., New York City.

TEXACO Greases

TEXACO

PERFECTED LUBRICATION FOR ANTI-FRICTION BEARINGS

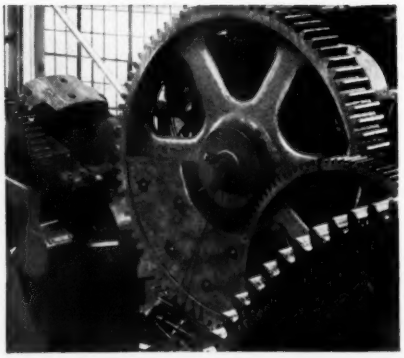


You can get far longer life, greater safety, from your wire rope by lubricating it regularly with Texaco Crater Compound A.

Texaco Crater Compound A coats each wire of every strand in a tough, viscous film that reduces internal and external friction, checks corrosion. Texaco Crater Compound A *adheres* to metal despite heat, cold, dust or rain. Where other greases may drip or wash away, Texaco Crater Compound A clings.

For longer service from wire rope, get in touch with Texaco. Trained lubrication engineers are at your service. For prompt delivery phone the nearest of our railroad offices or write direct to The Texas Company.

RAILROAD GIANTS *are ready for maintenance of way service at every call, safe in action, when wire rope and gears are lubricated with Texaco Crater Compound A.*



FOR GEARS, TOO . . . *Texaco Crater Compound reduces wear, cushions shocks, quiets noise. Makes gears last longer.*

FREE BOOKLET . . . *32 pages of money-saving information on Texaco Crater and the lubrication of gears and wire rope.*

THE TEXAS COMPANY · TEXACO PETROLEUM PRODUCTS · RAILROAD OFFICES

ATLANTA	133 Carnegie Way	**SAN FRANCISCO** . .	820 Hearst Bldg.
CHICAGO . . .	332 So. Michigan Ave.	**ST. LOUIS**	1218 Olive Street
NEW YORK	135 East 42nd Street	**ST. PAUL**	1221 Pioneer Bldg.

TEXACO